Math 212
HalfExam 01

F 09 Sep 2016

Your name: _____

Exam instructions

Number of exercises	: 3
Permitted time	: 60 minutes
Permitted resources	: None

Instructor's note:

- Manage your time deliberately.
- An effort has been made to make the exercises as clear and unambiguous as possible. If the statement of an exercise seems unclear, briefly (one sentence) write your understanding of the exercise, then proceed.

Exercise	Total	(a)	(b)	(c)
1	/20			
2	/10			
3	/20	/5	/10	/5
Total	/50			

Exercise 1

(20 pt) Find an equation for the plane containing both (i) the point of intersection of the lines

$$L_1 : x = \frac{y+1}{3} = 1 - z, \qquad L_2 : 3 - x = \frac{y+2}{2} = \frac{z+4}{2}$$

and (ii) the line of intersection of the planes

$$H_1 : x + y + z = 6, \qquad H_2 : 2y - x = 0.$$

Hint: Break it down. First find the coordinates of the point P_0 of intersection of the lines L_1 and L_2. Also find an equation for the line L of intersection of the planes H_1 and H_2. Then put it all together to get an equation for the plane containing P_0 and L. Think geometrically!

Exercise 2

(10 pt) Find the point P^* in the line

$$L : \mathbf{r}(t) = (2t + 4, -2t, t - 4)$$

that is closest to the point $Q = (12, 6, 1)$. *Hint:* Think geometrically! Use vectors.

Exercise 3

(20 pt) At time $t = 0$, you espy a flying cockroach whizzing around your bedroom. Always quick on your feet, you apply your mad skillz of vector calculus to determine that the cockroach's position vector is given by

$$\mathbf{r}(t) = \left(\frac{4\sqrt{2}}{5} t^{\frac{5}{2}} - 1, t^2, \frac{2}{3} t^3 + 1 \right),$$

where the component functions are measured in meters, and t is measured in seconds. At time $t = 3$, you squash the sucker.

(a) (5 pt) Find the cockroach's velocity function $\mathbf{v}(t)$. What are the units of the component functions?

(b) (10 pt) Determine how far the cockroach travels from the time you spot it to the time you squash it.

(c) (5 pt) You suspect that the cockroach was flying to its nest. In one (!) sentence, explain how you can (use something about vectors to) locate the nest.